

Figure 1 – Starting sequence used for the codon modification of MUC1. The MUC1 expression cassette sequence is taken from the vector JNW656. Start and stop codons are bolded. Kozak sequence is italicised. Restriction sites are underlined.

5 **GCTAGCGCCACCATGTCTAGAACACCGGGCACCCAGTCTCCTTCTCCTGCT**
 GCTGCTCCTCACAGTGCTTACAGTTGTTACAGGTTCTGGTCATGCAAGCTCTAC
 CCCAGGTTGGAGAAAAGGAGACTTCGGCTACCCAGAGAAGTTAGTGCAGTGCCAGCT
 CTACTGAGAAGAATGCTGTGAGTATGACCAGCAGCGTACTCTCCAGGCCACAGcC
 CCGGTTCAGGCTCCTCCACCACTCAGGGACAGGGATGTCAGTCTGGCCCCGGCC
 10 **ACGGAACCAGCTTCAGGTTCAGCTGCCACCTGGGGACAGGGATGTCACCTCGGT**
 CCCAAGTCACCAGGCCAGCCCTGGGCTCCACCACCCGCCAGCCCACGATGTC
 ACCTCAGCCCCGGACAACAAGCCAGCCCCGGCTCCACCAGGCCCCCCCAGCCC
 ACGGTGTACCTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCACGGCC
 CCCAAGCCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCC
 15 **ACCGCCCCCCCAGCCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGCC**
 CGGGCTCCACCAGCCCCCCCAGCCCACGGTGTACCTCGGCCCCGGACACCAG
 GCCCAGCCCCGGCTCCACCAGCCCCCCCAGCCCACGGTGTACCTCGGCCCCG
 GACACCAGGCCGCCCCGGCTCCACCAGGCCGCCCCGAGCCCACGGTGTACCT
 CGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCCAAGCCCACG
 20 **GTGTCACCTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCCAAGCCCACG**
 AGCCCATGGTGTACCTCGGCCCCGGACAACAGGCCGCTTGGGCTCCACC
 GCCCCTCCAGTCCACAATGTCACCTCGGCCTCAGGCTCTGCATCAGGCTCAGC
 TTCTACTCTGGTGCACAACGGCACCTCTGCCAGGGTACCAACAAACCCCAGCCA
 GCAAGAGCACTCCATTCTCAATTCCCAGCCACACTCTGATACTCCTACCAACCC
 25 **TTGCCAGCCATAGCACCAAGACTGATGCCAGTAGCACTCACCAGGGTA**
 CCTCCTCTCACCTCTCCAATCACAGCACTTCTCCCCAGTTGTACTGGGTC
 TCTTCTTTTCTGTCTTTCACATTCAAACCTCCAGTTAATTCTCTCTGGA
 AGATCCCAGCACCGACTACTACCAAGAGCTGCAGAGAGACATTCTGAAATGTT
 TTTGAGATTATAAACAAAGGGGTTTCTGGGCCTCTCCAATATTAGTTAG
 30 **GCCAGGATCTGTGGTGGTACAATTGACTCTGGCCTCCGAGAAAGGTACCATCA**
 ATGTCACGACGTGGAGACACAGTTCAATCAGTATAAAACGGAAGCAGCCTCTC
 GATATAACCTGACGATCTCAGACGTCAGCGTGAAGTGATGTGCCATTCTTCT
 CTGCCAGCTGGGGCTGGGTGCCAGGCTGGGCATCGCGCTGCTGGTGT
 GGTCTGTGTTCTGGTGCCTGGCATTGTCTATCTCATTGCCCTGGCTGTCTG
 35 **TCAGTGCCGCCGAAAGAACTACGGGCAGCTGGACATCTTCCAGCCGGATA**
 CCTACCATCCTATGAGCGAGTACCCACCTACCAACCCATGGGCCTATGTG
 CCCCCTAGCAGTACCGATCGTAGCCCCTATGAGAAGGTTCTGCAGGTAATGG
 TGGCAGCAGCCTCTTACACAAACCCAGCAGTGGCAGCCACTTCTGCCAACTT
 GTCTAGATAGCTCGAG

40

Figure 2 – MUC1 sequence devoid of the 7x VNTR repeat sequence, prior to codon modification. The start and stop codons are bolded. Restriction cloning sites are underlined. The *B*₁*P*₁ and *B*₂*v*₁*C*₁ sites for insertion of the 7x VNTR fragment are double underlined.

5

ATGTCTAGAACACCGGGCACCCAGTCTCCTTCTTCCTGCTGCTGCTCCTCACA
 GTGCTTACAGTTACAGGTTCTGGTCATGCAAGCTCTACCCCAGGTGGAGAA
 AAGGAGACTTCGGCTACCCAGAGAAGTTAGTGCCTCAGCTACTGAGAAGAA
 TGCTGTGAGTATGACCAGCAGCGTACTCTCCAGCCACAGCCCCGGTTCAGGCT
 10 CCTCCACCACACTCAGGGACAGGATGTACTCTGGCCCCGGCCACGGAACCCAGCT
 TCAGGTTAGCTGCCACCTGGGGACAGGATGTCACCTCGGTCCCAGTCACCAG
 GCCAGCCCTGGGCTCCACCACCCGCCAGCCCACGATGTCACCTCAGCCCCG
 GACAACAAGCCCAATGTCACCTCGGCCTCAGGCTCTGCATCAGGCTCAGCTTC
 TACTCTGGTGACAACGGCACCTTGCCAGGGCTACCACAAACCCAGCCAGCA
 15 AGAGCACTCCATTCTCAATTCCCAGCCACCACTGATACTCCTACCACCCTTG
 CCAGCCATAGCACCAAAGACTGATGCCAGTAGCACTCACCATGCACGGTACCT
 CCTCTCACCTCCTCCAATCACAGCACTTCTCCCCAGTTGTACTGGGGTCT
 TTCTTTTCTGTCTTTCACATTCAAACCTCCAGTTAATTCTCTCTGGAAAGA
 20 TCCCAGCACCGACTACTACCAAGAGCTGCAGAGAGACATTCTGAAATGTTTT
 GCAGATTTAAACAAGGGGTTTCTGGCCTCTCCAATTTAAGTTCAGGCC
 AGGATCTGTGGTACAATTGACTCTGGCCTCCGAGAAGGTACCATCAATGT
 CCACGACGTGGAGACACAGTTCAATCAGTTAAAACGGAAGCAGCCTTCCGATA
 TAACCTGACGATCTCAGACGTCAGCGTGAGGTGATGTGCCATTCCTTCTCTGC
 25 CCAGTCTGGGGCTGGGTGCCAGGCTGGGGCATCGCGCTGCTGGTGCTGGTC
 TGTGTTCTGGTTGCGCTGGCCATTGTCTATCTCATTGCCTGGCTGTCTGTCAG
 TGCCGCCGAAAGAACTACGGGCAGCTGGACATTTCCAGCCCGGGTACCTTA
 CCATCCTATGAGCGAGTACCCCACCTACCACACCCATGGCGCGTATGTCCCC
 CTAGCAGTACCGATCGTAGCCCCTATGAGAAGGTTCTGCAGGTAATGGTGGGC
 30 AGCAGCCTCTTTACACAAACCCAGGCAGTGGCAGCCACTCTGCCAACTTGTCT
AGATAG

Figure 3 – Two representative MUC1 codon modified sequences

Sequence 1

5 ATGAGCCGGACCCCTGGCACCCAGTCTCATTCTTCCTGCTCCTGCTGCTCAC
 CGTCTGACCGTGGTGACGGGAAGCGGCCACGCTTCGTCCACGCCGGCG
 GAGAAGGAAACCAGTGCACCCCAGCGCAGCTCCGTGCCAGCTCCACCGAGA
 AAAACGCTGTGAGCATGACGTCCAGTGTCTCTAGCCATAGCCCCGGCTCT
 GGGAGCAGTACCAACCCAGGGCCAGGACGTGACTCTCGCCCCGCTACGGAGC
 10 CCGCTTCTGGCTCCGCCACCTGGGCCAGGACGTGACCTCTGTGCCGGT
 CACACGCCCTGCTCTGGCTTACCACTCCTCTGCCATGACGTGACCTCGG
 CTCCGGACAATAAGCCAACGTGACGAGTGCCAGCAGGGAGCGCCTCGGGTC
 CGCCAGTACCCCTGGTGCATAACGGGACCAAGTGTAGGGCCACCACCAACCC
 GCGTCGAAGAGCACCCCCCTCTATCCCGTCTCATCATAGCAGACACACCTACA
 15 ACCCTGGCGAGCCACAGCACCAAGACCGACGCTTCCACACATCATAGCAC
 CGTCCACCACACTACCAGCTCCAACCATTCCACCAAGCCCCAGCTGAGCACCG
 GAGTGTCTTCTCTTGAGCTCCATATCAGTAACCTCCAGTTCAACTCCAG
 CCTCGAGGACCCCTTACCGACTACTATCAGGAGCTGCAGCGGGACATCAGCG
 AGATGTTCTGCAGATCTACAAGCAGGGGGCTTCTCGGCCTGTCTAACATCA
 20 AGTTCCGCCCCGGCAGCGTCGTGGTGCAAGTTGACCCCTGGCCTTGGGAGGG
 CACCATCAACGTGCACGACGTGGAGACCCAGTTCAACCAGTACAAGACCGAGG
 CCGCCAGCAGGTATAACCTGACCATCTCCGACGCTCTGTGAGCGACGTCCCC
 TTCCCTTCTCCGCCAGAGCGGGCTGGGTGCCGGCTGGGCATCGCT
 TGCTCGTGTGGTGTGCAGTGGCTGGCCATCGTGTACCTGATGCC
 25 CTGGCCGTCTGTCAATGCAGGCAGAACTACGGCCAGCTGACATCTTCCC
 AGCTGGGATACCTATCATCCCAGAGCGGGCTGGGTGCCGGCTGGGCATCGCCT
 GCCGCTACGTTCCCTCCAGCACCGACCGCAGCCCTACGAGAAGGTGAGC
 GCCGGGAATGGGGGAGTTCTCTCTTACACAAACCCGCCGTGGCCGCCA
 CGAGCGCCAACCTCTCCAGGTGA
 30

Sequence 2

ATGTCCCGCACCCCTGGCACCCAGTCCCCCTTCTTCTCCTGCTGCTGCTCAC
 GTGCTGACCGTCGTGACCGGAGCTGGCATGCGTCTCGACGCCGGCGCG
 35 AGAAGGAGACCAAGTGTACCCAGCGCAGCTCTGTGCCTCCAGCACGGAGAAG
 AACGCTGTGAGTATGACTTCTCCGTGCTGAGCTCCATAGCCCCGGCTCGGG
 CAGCTCCACCACCCAGGGCAGGACGTGACACTGGCTCCCGCAACCGAGCCC
 GCCTCTGGCTCTGCCGCCACCTGGGCCAGGACGTGACATCCGTGCCGTGA
 CCCGCCCGCCCTGGCAGCACCAACCCCCCTGCTCATGACGTACCTCTGC
 40 GCCTGACAACAAGCCTAACGTGACGTCCGCTTCCGGCAGCGCCTCCGGTCC
 GCCTCCACACTGGTGCATAACGGAACCTCCCGCGGCCACCACCAACCCAG
 CGAGCAAGAGCACCCCTCTATCCCCTCCCATATAGCGACACACCCACCA
 CGCTGGCCAGCCATAGCACCAAAACCGACGCCTCTAGCACCCACCACTCCACG
 GTGCCCTCCAGCAACATTCTACCTCCCCCAGCTGAGCACGG
 45 GGTGAGCTTTCTTCTGCTCTCCATATCAGCAACCTCCAGTTCAATTCTCT
 CTGGAGGACCCAGCACCGACTACTACCAAGAGCTGCAGCGGGACATCTCCGA
 GATTTCTGCAAGATCTACAAACAGGGGGCTTCTGGGATTGAGCAACATCAA
 GTTCCGCCCGGGTCCGTGGTGGTGAGCTCACCTGGCCTCAGGGAGGGC
 ACCATCAACGTGCATGACGTCAGACGACCTGAGGAGACCCAGTTCAATCAGTATAAGACCGAGGC
 50 CGCCTCCGGTACAACCTGACGATCAGCGACGTGTCGTGTCGCCAGTGCCT
 TCCCCTCTCGCACAGTCCGGCGCCGGCTGGGAGGGCATCGCCCT

GCTCGTGTGGTGTGCGTGCTCGTGGCCCTGCCATCGTGTACCTGATGCC
TGGCCGTCTGTCAGTGCAGGAGAAAGAACTATGGGCAGTTGGATATCTTCCCC
GCCAGGGACACCTACCACCCATGTCCGAGTACCCCACCTACCACACCCACGG
5 CCGCTATGTCCCTCCCTCCTCGACCGACCGCTCCCTTACGAGAAGGTGAGCG
CCGGCAACGGAGGCAGCTCCCTGTCCTACACCAACCTGCCGTGGCCGCCAC
AAGCGCCAACCTGAGCCGCTGA

Figure 4 – Engineered MUC1 codon modified sequence including restriction sites (underlined), Kozak sequence (italicised), start and stop codons (bolded), BbvCI (boxed) and Bspl (boxed). The later two features are essential for the re-introduction of the 7x VNTR fragment.

5 GCAGGGCGGCCGCGCTAGGCCACCATGTCTAGAACCCCTGGCACCCAGTCCC
 CCTTCTTCTCCTGCTGCTCACCGTGTGACCGTCGTGACCAGCAGTGGG
 CATGCGTCCTCGACGCCCGCGAGAAGGAGACCAAGTGTGACTACCCAGCGCA
 GCTCTGTGCCTTCCAGCACGGAGAAGAACGCTGTGAGTATGACTTCCCTCGTG
 10 CTGTCCTCCCATAGCCCCGGCTGGGCAGCTCCACCACCCAGGGCAGGACG
 TGACACTGGCTCCCGCAACCGAGGCCGCCCTGGCTCTGCCGCCACCTGGGG
 CCAGGACGTGACATCCGTGCCCCTGACCCGCCGCCCTGGGCAGCACCAAC
 CCCCCTGCTCATGACGTCACCTCAGCGCCTGACAACAAGCCTAACGTGACGTC
 CGCTTCCGGCAGCGCCTCGGCTCAGCCTCCACACTGGTGCATAACGGAACCT
 15 CGCGCGCGGCCACCACCAACCCCCAGCGAGCAAGAGCACCCCTCTATCCCC
 TCCCACATAGCGACACACCCACCACGCTGGCCAGCCATAGCACCAAAACCGA
 CGCCTCTAGCACCCACCACCTCCACGGTGCCCCCTGACCTCCAGCAACCATT
 CTACCTCCCCCCCAGCTGTCCACGGGGTGAGCTTTTCTTCCTGTCCCTCCATA
 TCAGCAACCTCCAGTTCAATTCTCTCTGGAGGACCCAGCACCGACTACTACC
 20 AAGAGCTGCAGCAGGACATCTCCAGATGTTCTGCAGATCTACAAACAGGGC
 GGCTTCTGGATTGAGCAACATCAAGTCCGCCGGGTCCGTGGTGTGCA
 GCTCACCCCTGGCCTTCAGGGAGGGCACCATCAACGTGCATGACGTCGAGACCC
 AGTTCAATCAGTATAAGACCGAGGCCGCCTCCGGTACAACCTGACGATCAGC
 GACGTGTCTGTGTCCGACGTGCCCTTCCCTCTCCGCACAGTCCGGCGCCGG
 25 CGTCCGGGCTGGGCATCGCCCTGCTCGTGTGGTGTGCGTGCTCGTGGCC
 CTCGCCATCGTGTACCTGATCGCCCTGGCCGTCTGTCAGTGCAGGAGAAAGAA
 CTATGGGCAGTTGGATATCTTCCCGCCAGGGACACCTACCAACCCATGTCCG
 AGTACCCACCTACCAACACCCAGGCCCTATGTCCCTCCCTCGACCGAC
 CGCTCCCTTACGAGAAGGTGAGCGCCGGCAACGGAGGCAGCTCCCTGTCC
 30 ACACCAACCCTGCCGTGGCGCCACAAGGCCAACCTGTAGATGACTCGAG
 GGATCCGCAG

Figure 5 – Final codon modified sequence of the MUC1 expression cassette containing the 7x VNTR fragment from JNW758. This cassette has a codon coefficient index of 0.699. Restriction sites are underlined, start and stop codons are bolded, the Kozak sequence is italicised, the BbvCI and BpI sites are boxed, and the positions of the two silent mutations are double underlined.

5 GCTAGCGCCACCATGTCTAGAACCCCTGGCACCCAGTCCCCCTTTCTCCTG
 CTGCTGCTCACCGTGCTGACCGTCGTGACCGGAGTGGCATGCGTCCTCGA
 CGCCCAGGCGAGAAGGAGACCAGTGCTACCCAGCGCAGCTGTGCCTTC
 10 CAGCACGGAGAAGAACGCTGTGAGTATGACTTCCTCCGTGCTGTCCCTCCATA
 GCCCGGGCTCGGGCAGCTCCACCACCCAGGGGAGGACGTGACACTGGCTCC
 CGCAACCGAGCCCGCCTCTGGCTCTGCCGCCACCTGGGGCAGGACGTGACA
 TCCGTGCCGTGACCCGCCCTGGCAGCACCAACCCCCCTGCTCATG
 ACGTCACCTCAGCCCCGGACAACAAGCCAGCCCCGGCTCCACCGGCCCCCCCC
 15 AGCCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGCCGGCTCCACC
 GCCCCCCCCCAGCCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGCCCC
 GGCTCCACCGCCCCCCCAGCCCACGGTGTACCTCGGCCCCGGACACCAGGC
 CGGCCCCGGGCTCCACCGGCCCCCCCAGCCCACGGTGTACCTCGGCCCCGG
 CACCAGGGCCGCCCGGGCTCCACCGCCCCCCCAGCCCACGGTGTACCTCG
 20 GCCCGGACACCAGGCCCGGGCTCCACCGCCCCCCCAGCCCACGGTGTACCTCG
 GTCACCTCGGCCCCGGACACCAGGCCGGCCGGCTCCACCGCCCCCAAG
 CCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGCCGGCTCCACCGC
 CCCCCCAGCCCATGGTGTACCTCGGCCCCGGACAACAGGCCGCCTTGGC
 TCCACCGCCCCCTCCAGTCCACAATGTACCTCGGCCCTCAGGCTCTGCATCAGG
 25 CTCAGCCTCCACACTGGTGCATAACGGAACCTCCGCGCGCCACCACCACC
 CAGCGAGCAAGAGCACCCCTCTATCCCCTCCATCATAGCGACACACC
 ACCACGCTGGCCAGCCATGCACCAAAACGACGCCCTTAGCACCCACCCT
 CACGGTGCCCCCCCTGACCTCAGCAACCATTCTACCTCCCCAGCTGTCCA
 CGGGGGTGAGCTTTCTCCTGTCCCCATATCAGCAACCTCCAGTTCAATT
 30 CCTCTCTGGAGGACCCAGCACCGACTACTACCAAAAGAGTTGCAGGGGACATC
 TCCGAGATGTTCCCTGCAGATCTACAAACAGGGCGGCTTCTGGGATTGAGCAA
 CATCAAGTTCCGCCCCGGGTCCGTGGTGCAGCTACCCCTGGCCTTCGAG
 GAGGGCACCATCAACGTGCATGACTCGAGACCCAGTTCAATCAGTTAAGAC
 35 CGAGGGCCGCCTCCGGTACACCTGACGATCAGCGACTGTCTGTCCGA
 GTGCCCTCCCCCTCCGCACAGTCGGCGCCGGGTGCCTGGCTGGGGGA
 TCGCCCTGCGTGTGGGTGCGTGTCCGTGCCCCTCGCCATCGGTGTACCT
 ATCGCCCTGGCCGTCTGTCAGTGCAGGAAAGAACATGGGCAGTTGGATAT
 CTTCCCCGGCCAGGGACACCTACCCACCCATGTCCGAGTACCCACCTACCCAC
 40 CCCACGGCCGTATGTCCCTCCCTCGACCGACCCGTCCCCCTACACCACCCTGCCGGT
 GTGAGGCCCGGCAACGGAGGCAGCTCCGTCTACACCACCCTGCCGGT
 CCGCCAACGCCCAACTGTCAGTGACTCGAG

Figure 6 – Comparison of expression of native MUC1 (JNW656) and codon modified MUC1 (JNW758) following transient transfection into CHO cells.

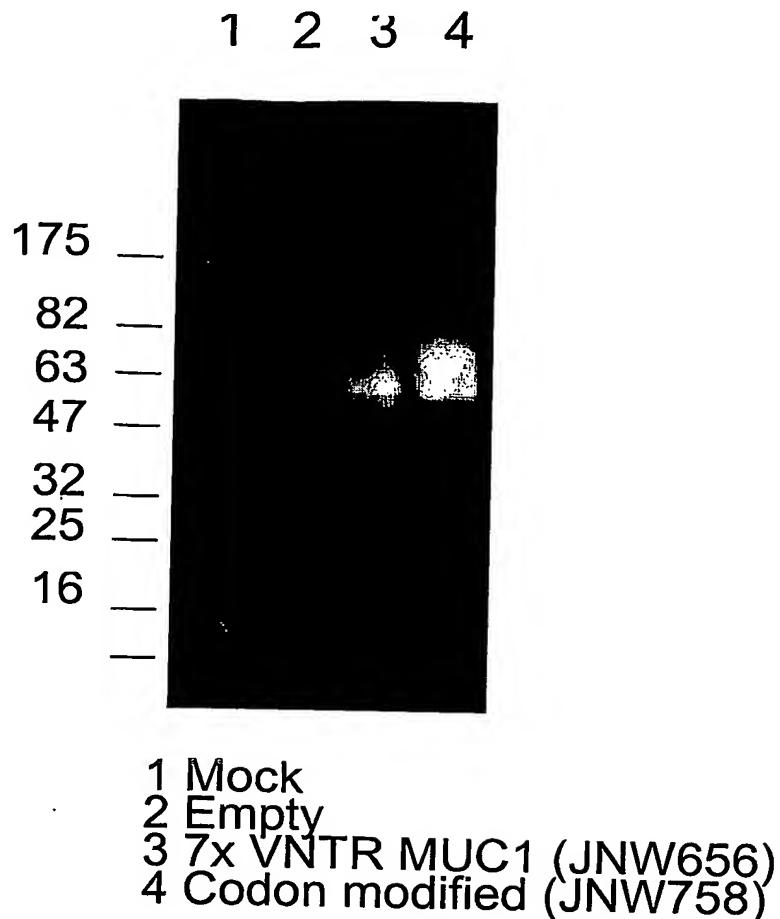


Figure 7 – Comparison of the IFN γ ELISPOT cellular responses following PMID immunisation with pVAC empty (control), 7x VNTR MUC1 (JNW656) and codon modified 7x VNTR MUC1 (JNW758). SAP is the CD8 MUC1 epitope SAPDNRPAL.

5 Each bar represents an individual mouse.

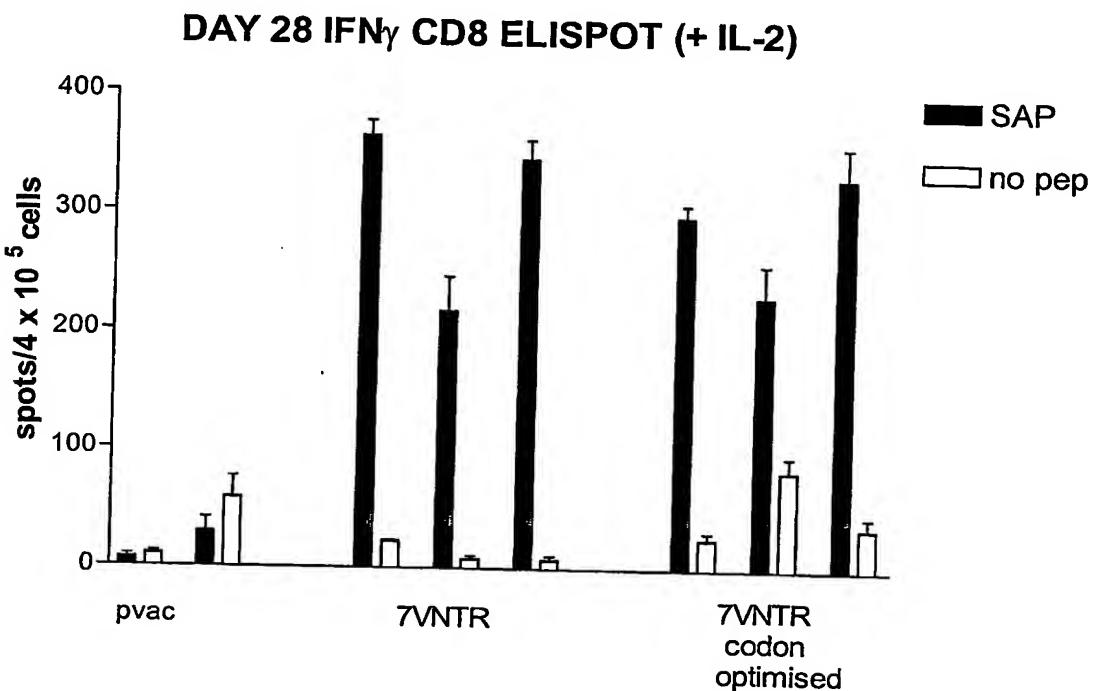
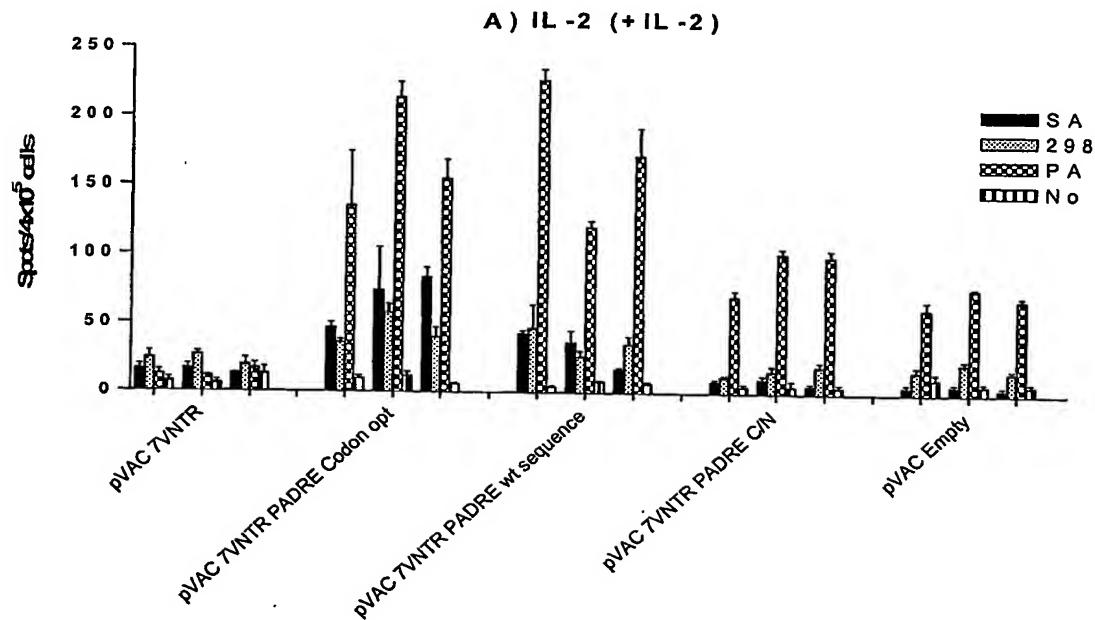


Fig 8. Comparison of the IL-2 ELISPOT cellular responses following PMID immunisation with PVAC 7 VNTR, PVAC 7 VNTR-PADRE-C (codon optimised sequence), PVAC 7 VNTR-PADRE-C (wt sequence), PVAC 7 VNTR-PADRE C/N' (codon optimised sequence) and PVAC empty (control). Responses were read using SAP (CD8 T cell MUC1 peptide), 298/9 (CD4 T cell MUC1 peptide) and PADRE peptide. Analysis was performed at day 28 (A) and 49 (B).



10

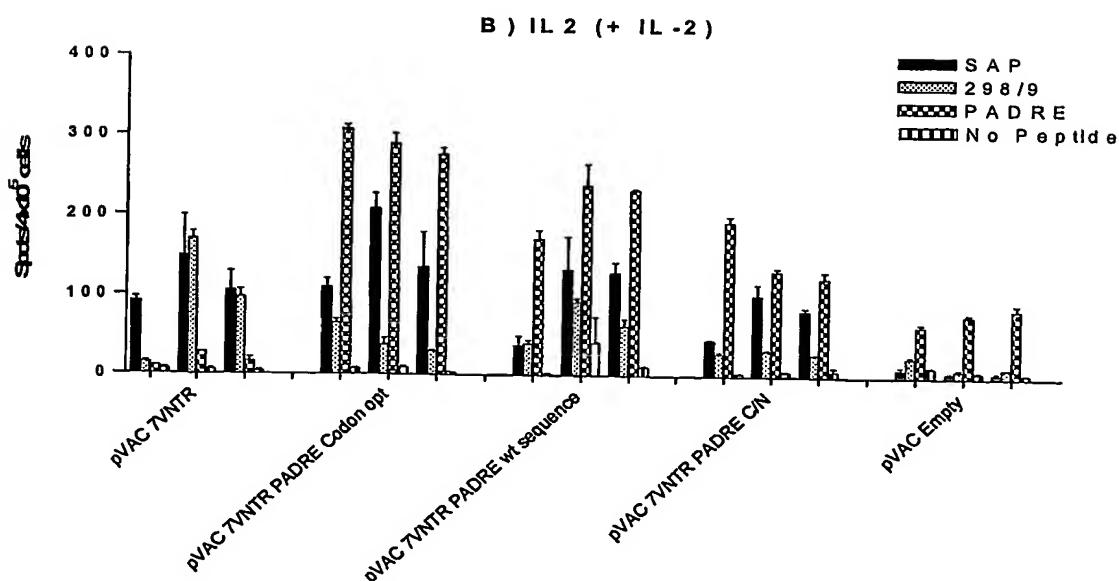


Figure 9**7x VNTR MUC1 (plasmid JNW656)**

Protein sequence

5 MSRTPGTQSPFFLLLLTVLTVVTGSGHASSTPGGEKETSATQRSSVPSSTEKN
 AVSMTSSVLSSHSPGSGSSTTQGQDVTLAPATEPASGSAATWGQDVTSVPVT
 RPALGSTTPPAHDVTSAPDNKPAPGSTAPPAHGVTsapdtrpapgstappaHG
 VTSAPDTRPAPGSTAPPAHGVTsapdtrpapgstappaHGVTsapdtrpapgs
 10 TAPPAHGVTsapdtrpapgstapaaHGVTsapdtrpapgstapqaHGVTsapd
 TRPAPGSTAPPAHGVTsapdnRPALGSTAPPVHNVTsASGSASGSASTLVHNG
 TSARATTPASKSTPFSIPSHSDTPTTLASHSTKTDASSTHHSTVPPLTSSNHS
 TSPQLSTGVSFFLSFHISNLQFNSSLEDPSTDYYQELQRDISEMFLQIYKQGGF
 LGLSNIKFRPGSVVVQLTLAFREGTINVHDVETQFNQYKTEAASRYNLTISDVS
 15 VSDVPFPFSAQSGAGVPGWGIALLVLVCVLVALAIYLIALAVCQCRRKNYG
 QLDIFPARPTYHPMSEYPTYHTHGRYVPPSSTDSPYEKVSAGNGGSSLSYTN
 PAVAATSANLSR.

DNA sequence

20 ATGCTAGAACACCGGGCACCCAGTCCTTCTTCTGCTGCTCCTCACAGTGCTTACAGTTGTTACAGGTTCTGG
 TCATGCAAGCTCTACCCCAGGTGGAGAAAAGGAGACTTCGGCTACCCAGAGAAAGTTCAAGTGCCTCAGCTACTGAGAAGA
 ATGCTGTAGATGACCAGCAGCGTACTCTCCAGGCCACAGCCCCGGTTCAGGCTCCACCACCTCAGGGACAGGATGTC
 ACTCTGGCCCCGGCACGGAACAGCTTCAGGTTCACTGCCACCTGGGACAGGATGTCACCTCGGTCCAGTCACCAG
 25 GCCAGCCCTGGGCTCCACCACCCCGCCAGCCACGGATGTCACCTCACGCCGGACAACAAGGCCAGCCCCGGCTCCACCG
 CCCCCCAGCCACGGTGTCACTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCCCCCAGCCACGGTGTCACTCGGCCCCGGACACCAG
 ACCTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCCCCCAGCCACGGTGTCACTCGGCCCCGGACACCAGGCCGGGGCTCCACCG
 GCGGGCCCCGGCTCCACCGCCCCCCCCAGCCACGGTGTCACTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCGGACACCAG
 30 CCCTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCCCCCAGCCACGGTGTCACTCGGCCCCGGACACCAGGCCACGGTGT
 ACCTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCCCCCAGCCACGGTGTCACTCGGCCCCGGACACCAGGCCGGGGCTCCACCG
 GCGGGCCCCGGCTCCACCGCCCCCCCCAGCCACGGTGTCACTCGGCCCCGGACACCAGGCCGGGGCTCCACCGCCCCGGACACCAG
 CCCCTCCAGTCCACAATGTCACCTCGGCCCTCAGGCTCTGATCAGGCTCAGCTTCTACTCTGGTGCACAACGGCACCTCT
 GCCAGGGCTACCCACAACCCCAGCCAGCAAGAGCACTCCATTCTCAATTCCAGCCACACTCTGATACTCCTACCCCT
 35 TGCCAGCCATAGCACCAAGACTGATGCCAGTAGCACTCACCACAGCACGGTACCTCTCACCCTCTCAACCTCTCAATCACAGCA
 CTTCTCCCAAGTTGCTACTGGGTCTCTTCTTCTGTCTTCACTTCAAACTCCAGTTTAATTCTCTCTG
 GAAGATCCCAGCACCAGACTACTACCAAGAGAGCTGCAGAGAGACATTCTGAAATGTTTGCAAGATTATAACAAGGGGG
 TTTTCTGGCCTCTCCAATATTAAGTCAGGCCAGGATCTGGTGGTACAATTGACTCTGGCCTCCGAGAAGGTACCA
 TCAATGTCACGACGGAGACACAGTTCAATCAGTATAAAACGGAAGCAGCCTCTCGATATAACCTGACGATCTCAGAC
 40 GTCAGCGTGAAGTGTGCCATTCTTCTGCCCAGTCTGGGCTGGGTGCCAGGCTGGGCACTCGCGCTGCTGGT
 GCTGGTCTGTGTTCTGGTGCCTGGCCATTGCTATCTCATTGCTTGGCTGTCTGTCAGTGCAGGAAAGAACTACG
 GGCAAGCTGGACATCTTCCAGCCGGGATACCTACCATCTATGAGCGAGTACCCACCTACCAACCCATGGCGCTAT

GTGCCCTAGCAGTACCGATCGTAGCCCTATGAGAAGGTTCTGCAGGTAATGGTGGCAGCAGCCTCTCTTACACAAA
CCCAGCAGTGGCAGCCACTTCTGCCAACTTGTCTAGATAG